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# APPRENTICESHIP TRAINING

**MOTOR  
MECHANIC  
Program**


**Alberta**

**MANPOWER**

**Apprenticeship and Trade  
Certification Division**

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## COURSE OUTLINE

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## **MOTOR MECHANIC TRADE**

### **THE GOAL OF APPRENTICESHIP TRAINING**

To develop a competent tradesman who, through skill and knowledge, is capable of repair abilities required to satisfactorily service the basic as well as the technically sophisticated components of the automotive units being used today.

### **THE PRODUCT OF APPRENTICESHIP—**

a graduate who will:

- \* repair and maintain private light commercial vehicles which are mainly powered with gasoline engines.
- \* comprehend work orders, technical bulletins and estimates, and relate the information to the job at hand.
- \* interpret warranty policy in terms of service reports, component failures and analysis records.
- \* when his Certificate of Proficiency has been earned, the Motor Mechanic may opt to specialize in the repairing, rebuilding and servicing of any one or more of the many assemblies of the modern motor car.
- \* have executive and supervisory opportunities in the automotive industry are frequently available to trained and certified mechanics with above capabilities and motivation.
- \* be able to familiarize himself with the work experience of closely allied trades; e.g. Heavy Duty Mechanic, Auto Body Mechanic, Machinist and Welder.

## **MOTOR MECHANIC APPRENTICESHIP INFORMATION**

### **Basic Requirements:**

- \* Indenture for 4 periods of Trade experience.
- \* Attend an 8 week technical training course in all four periods.
- \* Fulfill the requirements for each period including 1800 hours of work experience inclusive of time spent at the training course; successfully complete the technical training course and obtain a satisfactory employer's report.
- \* Education — a minimum requirement is the completion of grade 9 or a pass on an equivalent entrance examination as prescribed by the Trade regulation.
- \* Age — the minimum age for apprentices is 16 years. There is no upper age limit.

### **Credits:**

- \* Accelerated patterns of apprenticeship may be granted for related technical training and/or experience.

### **Benefits:**

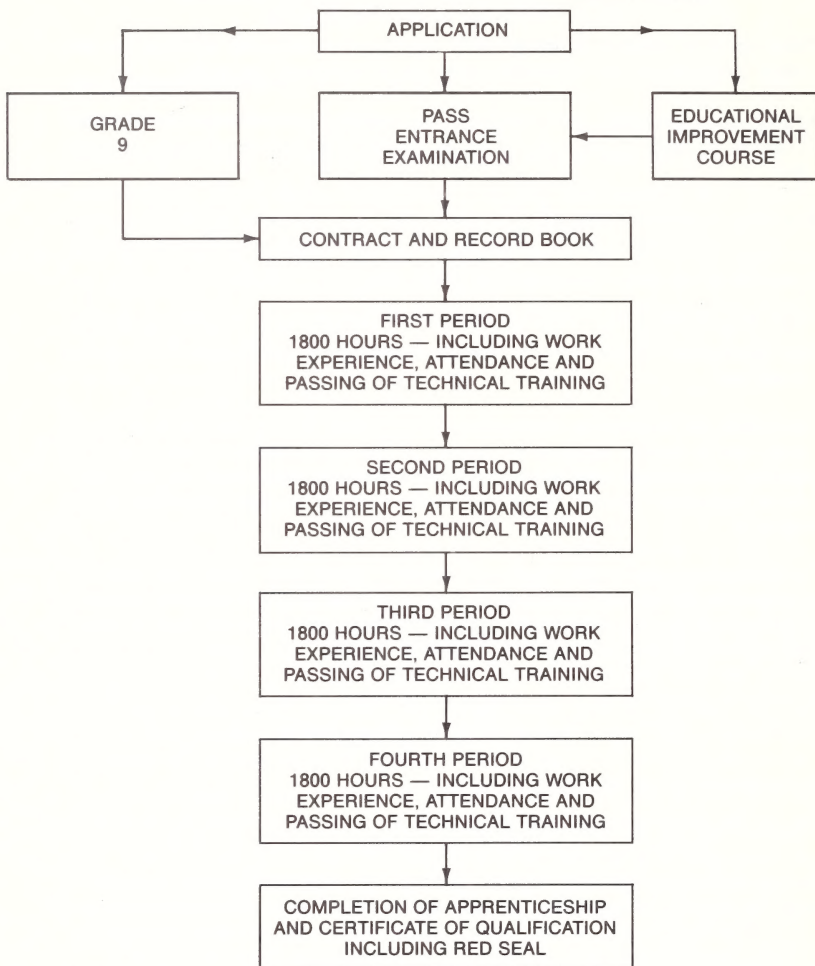
- \* Apprenticeship is a learning-while-earning program. During the apprenticeship period, while working at the trade, apprentices are assured by regulation of a minimum percentage of the prevailing journeyman rate: 55% during the first period, 70% during the second period, 80% during the third period and 90% during the fourth period. Progress from one rate to the next takes place only after successful completion of all the requirements for each period (details are outlined in the Record Book).
- \* All apprentices 17 years of age and older are normally eligible for training allowances while attending technical training courses. These allowances are funded by the Canada Employment and Immigration Commission.
- \* Administrative procedures establishing the amount of training allowance is complex and can vary with an individual's circumstances. Contact a local Canada Employment Centre for details.
- \* An apprentice who successfully completes the program will graduate with an Alberta Completion of Apprenticeship Certificate and a Certificate of Proficiency. It is also possible for the graduate to obtain an interprovincial Red Seal by passing an additional examination and so become recognized as a qualified tradesman throughout Canada.
- \* The most significant benefit to the graduate apprentice is that he is well trained in technical and practical aspects of the trade and is able to make a worthwhile and productive contribution to society. Society in return, will provide an opportunity for livelihood.



## **DIRECTIONS FOR PROSPECTIVE APPRENTICES**

- \* Contact your nearest Apprenticeship and Trade Certification Division for detailed information and counselling (see list of offices on page 47).
- \* Obtain an application form from the Apprenticeship and Trade Certification Division and neatly complete, in full, the information requested of the apprentice.
- \* Persevere in the search for apprentice employment and upon obtaining employment, give the application to the employer. It should be completed and returned to an Apprenticeship and Trade Certification Division forthwith.
- \* Any time credit, for previous experience in the Motor Mechanic trade, should be discussed with the employer and requested on the application form by the employer.
- \* Attach to the apprentice application a copy (transcript) of the marks for your last year of school. Applicants who do not have their school transcripts or a grade 9 standing are required to write an entrance examination. If transcripts have been lost, contact Alberta Education for information on school transcripts.
- \* A contract of apprenticeship is entered into between the apprentice and the employer and should be signed within 90 days after the apprentice application has been approved. If contracts have not been issued within this time, contact the Apprenticeship and Trade Certification Division.
- \* Before signing the contract of apprenticeship read the complete document carefully — know your obligations and responsibilities to your employer — know the employer's obligations and responsibilities to you — feel confident you have selected the right occupation.
- \* Know when you will be expected to attend classes and be prepared to attend. In early May of each year, School Schedules are sent to you and your employer. The employer also receives a class selection card for you, which is to be completed and submitted for scheduling. Information on procedures also accompanies the above. Confirmation on the date you actually get scheduled and/or the Official Notice will follow at the appropriate time(s).
- \* Prepare in advance for the financial obligations required of you during school training. Reference materials and school supplies are paid for by the apprentice.
- \* While an apprentice, it will be your responsibility to respond promptly to mailed directions and requests from the Apprenticeship and Trade Certification Division.

## APPRENTICESHIP ROUTE TOWARD CERTIFICATION





## **APPRENTICESHIP COMMITTEE STRUCTURE**

### **Motor Mechanic Provincial Apprenticeship Committee**

The Provincial Apprenticeship Committee for the Motor Mechanic Trade is comprised of members from Local Apprenticeship Committees from the cities of Edmonton, Calgary, Lethbridge, Grande Prairie, Fort McMurray, Red Deer, Vermilion, Medicine Hat and Peace River.

This Committee is concerned with the policies that guide the program and make recommendations to the Apprenticeship and Trade Certification Board and the Director of Apprenticeship and Trade Certification Division in the following areas:

- \* Contribute current information relative to changes in the trade and requirements of industry.
- \* Make recommendations for changes to existing trade regulations.
- \* Assist in updating of the training program through recommendations for revisions to the course outline and attendant examinations.

### **Motor Mechanic Local Apprenticeship Committee**

Local Apprenticeship Committees are concerned with individuals and trade situations within a local region. Meetings are held throughout the year to make recommendations and to discuss problems relating to the apprenticeship program. Members who serve on committees are nominated by employer and labour organizations, and membership is equally divided into employer and employee representation in accordance with The Manpower Development Act.

## **Apprenticeship Committee Members:**

Mr. M. B. Livingston — Edmonton — Employer  
Mr. D. Bodnaruk — Edmonton — Employer (Alternate)  
Mr. K. D. Scaman — Edmonton — Employee  
Mr. J. Jorgensen — Edmonton — Employee  
Mr. J. Kudryk — Edmonton — Employer  
Mr. J. Morse — Edmonton — Additional Member  
Mr. W. Wilson — Calgary — Employer  
Mr. J. Rae — Calgary — Employer  
Mr. K. V. Evenson — Calgary — Employee  
Mr. J. M. MacLean — Calgary — Employee  
Mr. L. C. Bratko — Calgary — Employee (Alternate)  
Mr. H. P. Shellenberg — Lethbridge — Employer  
Mr. P. Schipper — Lethbridge — Employer  
Mr. J. P. Giacchetta — Lethbridge — Employee  
Mr. J. DeJager — Lethbridge — Employee  
Mr. G. C. Olson — Grande Prairie — Employer (Alternate)  
Mr. D. Gray — Red Deer — Employer  
Mr. J. Stryker — Red Deer — Employee  
Mr. V. Odenbach — Medicine Hat — Employer  
Mr. S. Bull — Medicine Hat — Employer  
Mr. M. Kurpiuwett — Medicine Hat — Employee  
Mr. R. Lynde — Medicine Hat — Employee  
Mr. C. F. Ross — Grande Prairie — Employer  
Mr. A. Perry — Grande Prairie — Employee  
Mr. D. Nilsson — Grande Prairie — Employee (Alternate)  
Mr. G. W. Ellert — Fort McMurray — Employer  
Mr. W. Mayowski Jr. — Vermilion — Employer  
Mr. P. J. Howorko — Vermilion — Employee  
Mr. G. C. Webb — Vermilion — Employer (Alternate)  
Mr. G. Tomiak — Vermilion — Employee (Alternate)  
Mr. F. J. Gaydosh — Peace River — Employee (Alternate)  
Mr. M. Paquette — Peace River — Employer (Alternate)  
Mr. N. S. Sandboe — Peace River — Employer  
Mr. Z. Wojciechowski — Hinton — Employer  
Mr. L. Schooley — Hinton — Employer (Alternate)  
Mr. L. Ovelson — Hinton — Employee

## **MOTOR MECHANIC PROGRAM COURSE OUTLINE**

This outline has been prepared in accordance with recommendations from the Provincial Apprenticeship Committee for the Motor Mechanic Trade in the Province of Alberta.

The outline was updated following consideration given to recommendations and suggestions from:

- Local Apprenticeship Committees
- Representatives from training institutes
- Curriculum Sub-Committee from the Provincial Apprenticeship Committee

### **PROCEDURES FOR RECOMMENDING REVISION(S) TO THE COURSE OUTLINE**

Any concerned citizen or group in the Province of Alberta may make recommendations for change by writing to the Apprenticeship and Trade Certification Division, Edmonton.

It is requested that recommendations for change refer to specific areas and state references used. Recommendations received will be placed before regular meetings of the Provincial Apprenticeship Committee.

## **PREFACE**

The lectures, demonstrations and assignments listed in the course outline are intended to familiarize the Motor Mechanic apprentice with the scope of his trade and to train him in necessary skills. Classroom subjects were carefully chosen to relate the skills required in modern automotive industry.

### **The Ratio of Theory and Shop**

- \* In the interests of flexibility, the outline for the Motor Mechanic trade is not divided into identified Theory and Shop divisions.
- \* Though the specific characteristics of certain items of subject material cannot be effectively covered by both Shop and Theory situations, the objective ratio should be directed towards a 50/50 proportion as far as practically feasible.

### **Mathematics and Science (related subjects)**

- \* The subjects of Mathematics and Science have been determined as being integral components of the technical training when they are applied in the strictest terms of trade involvement, specifically being totally related.
- \* These knowledge areas, therefore, are more realistically recognized as being actually Theory items in the trade coverage, rather than Mathematics and Science and self-supporting subject entities.

NOTE: The "shop" and "theory" time allotments shown are approximate only and may vary from class to class in the interests of flexible instruction.

## **SAFETY EDUCATION**

Safe working procedures and conditions, accident prevention and the preservation of health is of primary importance in the Apprenticeship programs in Alberta. These responsibilities are shared and require the joint efforts of the government, employers, employees and the general public. Therefore, it is imperative that all parties become aware of circumstances that may lead to injury or harm and that safe learning experiences and environment can be created by controlling the variables and behaviors that may contribute to or cause an accident and/or an injury.

It is generally recognized that a safe attitude contributes to an accident free environment. As a result a healthy safe attitude towards accidents will benefit an employee by helping to avoid injury, loss of time and loss of pay.

A tradesman is possibly exposed to more hazards than any other person in the work force and therefore, should be familiar with the Occupational Health and Safety Act and Regulations dealing with his own personal safety and the special safety rules applying to each job.

### **LEGAL AND ADMINISTRATIVE ASPECTS**

#### **Employer's Responsibilities:**

Accident prevention and the provisions of safe working conditions are the responsibilities of an employer. The company is responsible for:

1. The provision and maintenance of safety equipment
2. The provision of protective devices and clothing (as required by the Occupational Health & Safety Act, General Safety Regulations)
3. The enforcement of safe working procedures
4. Adequate safeguards for machinery, equipment and tools
5. Observance of all accident prevention regulations
6. Adequate training to allow a worker to use or operate equipment in an effective and safe manner.

#### **Government's Responsibilities:**

The Apprenticeship and Trade Certification Division in conjunction with the respective Provincial Apprenticeship Committee assumes the responsibility to assure that adequate safety is reflected in the curriculum and that adequate safety instruction is presented at the training establishments.

The Occupational Health and Safety Inspection Branch assumes the responsibility for periodic inspection of the operation to ensure that regulations for industry are being correctly observed.

#### **Individual's Responsibilities:**

The employee is responsible for:

1. Knowing and working in accordance with the safety regulations pertaining to job environment and
2. Working in such a way as not to endanger himself or his fellow employees

The major factor in safety is the individual employee, his personal attitude toward safety and having an awareness of the respective safety regulation.

## MOTOR MECHANIC PROGRAM

### Subjects and Time Distribution

<b>First Period</b>	<b>8 Weeks</b>	<b>30 Hours Per Week</b>	<b>240 Hours</b>	<b>Page</b>
Section One:	Basic Materials, Tools and Skills		27	11
Section Two:	Safe Use of Oxy-acetylene		10	14
Section Three:	Power Train		46	15
Section Four:	Suspension and Steering		91	17
Section Five:	Brake Systems		46	20
Section Six:	Electrical		20	23
<b>Second Period</b>	<b>8 Weeks</b>	<b>30 Hours Per Week</b>	<b>240 Hours</b>	<b>Page</b>
Section One:	Gasoline and Diesel Engines — Theory Service Repair		158	25
Section Two:	Rear Axle Assemblies		54	30
Section Three:	Drive Lines		6	31
Section Four:	Basic Electrical		22	32
<b>Third Period</b>	<b>8 Weeks</b>	<b>30 Hours Per Week</b>	<b>240 Hours</b>	<b>Page</b>
Section One:	Charging Systems		76	33
Section Two:	Cranking Systems		33	34
Section Three:	Ignition Systems		49	35
Section Four:	All Fuel Systems		54	37
Section Five:	Tune-Up and Accessories		28	39
<b>Fourth Period</b>	<b>8 Weeks</b>	<b>30 Hours Per Week</b>	<b>240 Hours</b>	<b>Page</b>
Section One:	Automatic Transmissions		160	42
Section Two:	Air Conditioning		30	44
Section Three:	Special Options		20	44
Section Four:	Fuel Injection Systems		20	44
Section Five:	Review		10	45



# FIRST PERIOD TECHNICAL TRAINING

## SECTION ONE: BASIC MATERIALS, TOOLS AND SKILLS

27 Hours

### A. Terminology

1. Standard terms
2. Descriptions as to operational uses and material characteristics
3. Classification of terms, i.e. slang, localisms, etc.
4. Value of terminology

### B. Mechanical Measuring Tools

1. Units of linear measure (inc. metric)
2. Care and storage
3. Common types and applications
  - (a) rules, calipers, micrometers, dial indicators, etc.
4. Use and interpretation
5. Fraction — decimal conversion
6. Recognition of a measuring tools limitations
7. Using a straight edge
8. Transfers of measurements
9. Using protractors

### C. Hand Tools (Miscellaneous)

1. Stud and bolt removers
  - (a) types and applications
  - (b) procedures and precautions
  - (c) reconditioning holes for future use
    - (i) heli-coils, lap-lok, etc.
2. Flaring tools
  - (a) annealing copper tube
  - (b) single and double flaring techniques
  - (c) recognition of copper and brass tube fittings
  - (d) steel tubing repairs
  - (e) recognition of tube sizes
3. Reamers
  - (a) types and application
  - (b) correct procedures for reaming
  - (c) care and storage of reamers
  - (d) relationship of reamers to the materials to be worked on

4. Twist drills
  - (a) recognition of types and sizes
  - (b) reconditioning procedures and precautions
  - (c) relationship of lubricants to material to be drilled
  - (d) drilling faults and recognition of cause
  - (e) drilling technique
    - (i) drill speed, drill breakthrough, etc.
  - (f) general drilling safety precautions
5. Taps and dies
  - (a) types and applications of taps
    - (i) taper, plug, bottoming
  - (b) thread type recognition
  - (c) thread characteristics
    - (i) pitch, crown, depth, etc.
  - (d) tap failures and remedies
  - (e) care and storage of taps and dies
  - (f) calculations of tap drill sizes
  - (g) use and selection of lubricants
  - (h) die failures and remedies
  - (i) importance of thread "fit"
  - (j) threading procedures and precautions

## **D. Fastening Devices**

1. Bolts, nuts and capscrews
  - (a) sizing standards
  - (b) threading standards
  - (c) tensile grades
    - (i) recognition of markings
  - (d) bolt head designs
  - (e) nut types and functions
    - (i) lock, castellated, slotted, etc.
  - (f) interpretation of torque charts
  - (g) machine screws and nuts
    - (i) recognition, threads, sizing, etc.
  - (h) set screws
    - (i) sizing standards
    - (ii) types and functions
  - (i) removal of seized nuts, etc.
2. Washers
  - (a) types and designs
  - (b) sizing
  - (c) functions of washers
3. Keys and pins
  - (a) types
    - (i) woodruff
    - (ii) square
    - (iii) split pins (cotter)
    - (iv) tapered pins
    - (v) tubular pins

- (b) installation and removal procedures
- (c) use of special tools and methods
- 4. Rivets
  - (a) automotive types and applications
  - (b) installation and removal procedures
- 5. Locking rings
  - (a) shapes and functions
  - (b) types
  - (c) use of special tools
  - (d) removal and replacement procedures
  - (e) safety precautions
  - (f) locking ring to groove clearances

## **E. Safety**

- 1. Safe use of power tools
  - (a) grounding
  - (b) freedom from moisture and loose material
  - (c) state of repair
- 2. Safe handling of inflammable fluids
- 3. Correct use of fire extinguishers
- 4. Use of proper waste containers
- 5. Recognition of types of fires in relation to combat methods
- 6. Batteries and charging

## **F. Unemployment Insurance Commission**

- 1. Administrative authority
- 2. Benefit application
- 3. Conditions of benefits
- 4. Services

## **G. Occupational Health and Safety**

- 1. Administrative authority
- 2. Contribution structure
- 3. Governing conditions
- 4. Breadth of coverage

## **H. Apprenticeship and Trade Certification Division**

- 1. Governing administration
- 2. Organizational pattern

3. Management — labour participation
4. Comparison with other programs

**SECTION TWO:            SAFE USE OF OXY-ACETYLENE  
EQUIPMENT**

**10 Hours**

**A. Gases**

1. Oxygen
  - (a) recognition
  - (b) characteristics
  - (c) handling precautions
2. Acetylene
  - (a) recognition
  - (b) characteristics
  - (c) composition
  - (d) handling precautions
3. Construction details of cylinders

**B. Cylinders and Fittings**

1. Identification of each cylinder
2. Identification of fittings
  - (a) color
  - (b) thread
  - (c) size
3. Construction details of cylinders
  - (a) contents of acetylene cylinders
  - (b) safety provisions
  - (c) handling precautions
  - (d) recommended locations

**C. Regulators and Hoses**

1. Basic construction and function
2. Precautionary handling and maintenance procedures
3. Installation procedures and precautions
4. Identification of hoses
  - (a) coloring
  - (b) threads
  - (c) sizing standards
5. Care and handling of hose(s)
6. Detection of leaks
  - (a) methods
  - (b) precautions

#### **D. Torch**

1. Recognition of part terminology
2. Function of torch components
3. Recognition of tip sizes and types
4. Care and storage of torch and tips
  - (a) cleaning methods
5. Recognition of torch malfunctions
  - (a) back fires
  - (b) flash back
  - (c) over-heating
6. Prevention and correction of malfunctions

#### **E. Cutting and Burning Attachments**

1. Component recognition and terminology
2. Care and handling
3. Attaching procedures and precautions

#### **F. Basic Techniques**

1. Introduction to heating
  - (a) interpretation of metal color
  - (b) effect of heat on metal
2. Introduction to cutting
  - (a) recognition of "cuttable" metals
  - (b) recognition of suitable flame
  - (c) interpretation of the cutting process
  - (d) operational procedures and precautions
  - (e) specific safety procedures, eye and face protectors fire extinguishers, preliminary precautions

<b>SECTION THREE:</b>	<b>POWER TRAIN</b>	<b>46 Hours</b>
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<b>A. Clutch</b>	<b>15 Hours</b>
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1. Types and designs
2. Functions
3. Principle of operation
4. Recognition of components
  - (a) drive member(s)
  - (b) driven member(s)
  - (c) release mechanisms
5. Effect of adjustments

6. Construction details
  - (a) provision for heat dissipation
  - (b) provision for shock reduction
7. Characteristics of clutch materials
  - (a) facings
  - (b) springs
8. Recognition of inherent problems
  - (a) diagnosis
9. Effects of heat and friction
10. Remove and replace procedures and precautions
11. Adjustments (internal and external)
12. Flywheel and clutch housing alignment checks

## **B. Transmission**

**20 Hours**

1. Principle of operation
  - (a) types and designs
2. Basic function
3. Gear ratios
  - (a) methods of determining
  - (b) relation to power and work
  - (c) gearing principles
4. Construction and materials
5. Interpretation of service manuals
  - (a) proper disassembly and reassembly procedures
6. Tracing power paths
7. Part terminology and functions
8. Use of special tools
9. Synchro-mesh assemblies
  - (a) types and designs
  - (b) principles of operation
10. Lubrication provision
11. Inspection procedures of bearings
12. Interpretation of faulty transmission behaviour
13. Transmission shift pattern adjustments
14. Transmission types and designs
  - (a) 4 speed full synchro-mesh
  - (b) 5 speed truck transmission
  - (c) transfer cases



- (d) trans axles (standard transmission only)
- (e) five speed overdrive

**C. Diagnosis Procedures** **9 Hours**

1. Shifting mechanisms
2. Power transfer train
3. Recognition of faulty performance
4. Bearing testing and inspection
5. Determining and correcting alignment
6. Lubrication systems and lubricants
7. Adjusting procedures
8. Road testing procedures and interpretation

**D. Repair Procedures** **2 Hours**

1. Remove and replace procedures and precautions
2. Interpretation of service manuals
3. Fitting new or used parts

**SECTION FOUR: SUSPENSION AND STEERING** **91 Hours**

**A. Frames** **3 Hours**

1. Recognition of frame types
2. Functions of the frame
3. Frame terminologies
4. Sprung and unsprung weight

**B. Springs** **1 Hour**

1. Types
2. Characteristics
3. Functions
4. Service adjustment
5. Relationship of spring condition to vehicle performance
6. Service precautions
7. Shackles and fittings
8. Terminologies

- C. Other methods of Springing** **3 Hours**
1. Torsion bars
    - (a) principle of operation
    - (b) service procedure
    - (c) adjustments
- D. Shock Absorbers** **1 Hour**
1. Principle of operation
  2. Functions
  3. Types and design
  4. Remove and replace procedures
  5. Diagnostic procedures
  6. Bleeding for installation
  7. Air adjustable and gas charged
  8. Service procedure
- E. Independent Front and Rear Suspension and MacPherson Strut Suspension** **16 Hours**
1. Types and designs
  2. Functions
  3. Recognition and function of components
    - (a) control arms
    - (b) stabilizer assemblies
    - (c) adjustments
  4. Principles of operation
  5. Repair procedures and precautions
  6. Steering linkage and adjustments
  7. Relation to steering systems
  8. Relation to braking performance
- F. Axles (front “I” beam)** **3 Hours**
1. Types and applications
  2. Construction methods and materials
  3. Installation and adjustment of angles
  4. Recognition of parts and functions
  5. Relation to braking and steering systems

6. Service procedures
  - (a) king pins
  - (b) spindle supports

## **G. Wheels and Tires**

**3 Hours**

1. Types of tire construction
2. Tire construction material
  - (a) compatibility of tire types
3. Relationship of tires to vehicle type and weight
  - (a) D.O.T. ratings and sizing
4. Recognition and correction of tire unbalance
5. Interpretation of tire tread wear patterns
6. Types, function, lubrication and adjustments of wheel bearings
7. Safety characteristics of wheels
8. Torqueing and locking provisions
9. Importance of proper tire and wheel sizing in relation to vehicle design and safety
10. Space saver spares
  - (a) safety do's and don'ts
11. Mag wheels
  - (a) safety do's and don'ts

## **H. Steering**

**16 Hours**

1. Definition and function of steering angles
  - (a) caster, camber, k.p.i., toe-in, etc.
2. Recognition of adjustments (steering angle)
  - (a) methods and location
3. Common types of manual steering gears
  - (a) rack and pinion
  - (b) recirculating ball and nut
  - (c) worm and roller
  - (d) principles of operation
4. Steering gear adjustments
  - (a) correct sequence
  - (b) limitation of adjustments
  - (c) measuring bearing preloads
  - (d) recognition of steering gear ratio
  - (e) adjustment terminology
  - (f) interpretation of service manuals
5. Recognition of collapsible steering gears
  - (a) principle of operation
  - (b) special precautionary service procedures

6. Recognition, function and service procedures of
  - (a) king pins
  - (b) upper and lower ball joints
  - (c) steering knuckles
  - (d) tie rod ends
7. Lubrication and adjustment of front wheel bearings
  - (a) measuring preload
  - (b) locking methods

#### **I. Steering Angles and Measurements**

**22 Hours**

1. Recognition and functions
2. Caster, camber, king pin inclination
3. Steering axis inclination
4. Toe-in/toe-out
5. Steering angle measurements and adjustments
  - (a) front
  - (b) rear
6. Diagnosis and alignment procedures
  - (a) front
  - (b) rear

#### **J. Steering Gear Boxes**

**23 Hours**

1. Current types and designs
2. Principles of operation
3. Diagnosis procedures
4. Remove and replace procedures and precautions
5. Overhaul procedures and precautions
  - (a) adjustment sequence
  - (b) installation of seals
6. Power assisted steering gear boxes and pumps
  - (a) type identification
  - (b) diagnosis procedures
  - (c) remove and replace procedures
  - (d) recognition and function of components
  - (e) repair and adjustment procedures
  - (f) hydro boost units (bleeding procedures)

### **SECTION FIVE: BRAKE SYSTEMS**

**46 Hours**

#### **A. Drum Brakes**

**11 Hours**

1. Principle of operation (Pascal's Law)
  - (a) relation of temperature to volume increase

- (b) relation of gases to fluids
- (c) characteristics of a hydraulic brake fluid
- (d) relation of pressure to temperature
- 2. Types of brake shoe arrangements
  - (a) self energizing
  - (b) servo acting
  - (c) leading and trailing shoes
- 3. Wheel cylinders
  - (a) types and design
  - (b) overhaul procedures
- 4. Recognition and function of major components
- 5. Inspection and recognition of parts
- 6. Master cylinder types and designs
- 7. Master cylinder, principle of operation
- 8. Proper adjustment sequences
- 9. Installation and adjustment procedures
- 10. Properties of brake lining materials
- 11. Brake design in relation to heat dissipation
- 12. Basic design of brake systems (front wheel drive)

## **B. Disc Brakes (Front and Rear)**

**12 Hours**

- 1. Principle of operation
- 2. Common types and applications
- 3. Recognition of major components
  - (a) disc (rotor)
    - (i) types
    - (ii) details of construction
  - (b) calipers
    - (i) function
    - (ii) principles of operation
    - (iii) types and application
  - (c) valves
    - (i) types and applications
    - (ii) principles of operation
    - (iii) proportioning valve (load functioning)
  - (d) warning devices
    - (i) system pressure
    - (ii) pad wear indicators
- 4. Servicing precautions and procedures
- 5. Special materials required
  - (a) hydraulic brake fluid standards
  - (b) wheel bearing lubricant standards

6. Relation of front wheel bearing adjustment to brake operation
7. Front wheel drive
  - (a) basic design
  - (b) types and application

**C. Brake Booster Units (Power Brakes)**

**11 Hours**

1. Common types and applications
2. Principle of operation
3. Construction details
4. Recognition and function of major components
5. Part recognition and function
6. Service and bleeding procedures
7. Common causes of failure
8. Adjustments
9. Hydro-boost

**D. Mechanical Parking (Hand) Brakes**

**3 Hours**

1. Principle of operation
2. Common types and application
3. Adjustment procedures
4. Hand or parking
  - (a) types and applications
  - (b) adjustment and service
  - (c) recognition and function of components
5. Spring brake
  - (a) function and design
  - (b) safety precautions

**E. Warning Systems**

**3 Hours**

1. Residual pressure and fluid level
2. Brake light circuits
3. Metering valves
4. Proportioning valves
5. Diagnosis brake problems
  - (a) failures
  - (b) faulty operations
  - (c) diagnosis



<b>F. Lines and Hoses</b>	<b>3 Hours</b>
1. Materials	
2. Flaring	
3. Inspection	
4. Installations	
<b>G. Repair Procedures</b>	<b>3 Hours</b>
1. Methods and limitations	
2. Special tools and gauges	
3. Brake adjustment	
4. Bleeding procedures	
<b>SECTION SIX:</b>	<b>ELECTRICAL</b>
	<b>20 Hours</b>
<b>A. Basic Circuits</b>	<b>2 Hours</b>
1. Series	
2. Parallel	
3. Series parallel	
<b>B. Common Circuitry — Diagnosis</b>	<b>5 Hours</b>
1. Shorts	
2. Opens	
3. Grounded circuits	
4. Use of meters and test light	
<b>C. Batteries</b>	<b>2 Hours</b>
1. Basic principles of operation (not detailed)	
(a) lead/acid and maintenance free types	
<b>D. Construction and Materials</b>	<b>1 Hour</b>
<b>E. Ratings and Descriptions</b>	<b>1 Hour</b>
<b>F. Service and Testing Procedures</b>	<b>1 Hour</b>
1. Specific gravity	
2. Voltage readings	
3. Use of testing equipment	

<b>G. Recharging Procedures</b>	<b>2 Hours</b>
1. Handling precautions	
2. Recharging hazards	
3. Types and functions of rechargers	
<b>H. Cables and Connections</b>	<b>2 Hours</b>
<b>I. Connections, Diagrams and Patterns</b>	<b>3 Hours</b>
<b>J. Battery Boosting</b>	<b>1 Hour</b>
1. Hook ups	
2. Battery charging	

## SECOND PERIOD TECHNICAL TRAINING

### SECTION ONE: GASOLINE AND DIESEL ENGINES THEORY, SERVICE AND REPAIR

158 Hours

#### A. Engines

20 Hours

1. Forward material
  - (a) stages of development
  - (b) principles of operation
    - (i) relationship of stroke, bore and torque
    - (ii) the laws of mechanics as related to the internal combustion engine
  - (c) classification as to
    - (i) design
    - (ii) cooling methods
    - (iii) stroke-cycle
    - (iv) design of head
    - (v) valve arrangement
    - (vi) induction methods
  - (d) diesel and gasoline engine comparison

#### B. Engine Components

63 Hours

1. Engine blocks
  - (a) materials
  - (b) basic purpose
  - (c) relation of materials to heat and friction
  - (d) purpose of sleeves and liners
  - (e) cylinder measuring and reconditioning including liners
  - (f) journal alignment
  - (g) inspection and testing
    - (i) cracks, warpage, stoppages
2. Cylinders liners
  - (a) types
3. Pistons and piston rings
  - (a) materials
  - (b) functions
  - (c) designs and construction of pistons
  - (d) relation of pistons to heat expansion and heat control
  - (e) relation of pistons to reciprocal motion
  - (f) provisions for lubrication and cooling
  - (g) measuring, fitting and computing oversizes
  - (h) reconditioning requirements and methods
  - (i) piston pin fits and securing methods
  - (j) functions of piston rings
  - (k) construction and materials of piston rings
  - (l) installation procedures and precautions
  - (m) measuring "gap" and "clearance"

- (n) types of piston rings
  - (o) designs of oil control piston rings
4. Connecting rods
    - (a) functions
    - (b) materials and designs
    - (c) bushing materials
    - (d) identification of connecting rods
    - (e) bushing fits and tolerances
    - (f) bearing insert materials
    - (g) lubrication provisions
    - (h) bearing insert characteristics
    - (i) relation of bearings to heat and friction
    - (j) testing, straightening, resizing and weight balancing connecting rods
  5. Crankshaft
    - (a) function
    - (b) design (in relation to engine type, etc.)
    - (c) materials
    - (d) method(s) of construction
    - (e) crankshaft in relation to balance and vibration
    - (f) crankshaft assemblies, parts of
    - (g) inspection of journal surfaces
    - (h) crankshaft bearing, types and designs
    - (i) lubrication provision
    - (j) installation precautions and procedures
    - (k) measuring for wear, taper, flatness and end play
    - (l) principle of magnafluxing
    - (m) flywheel and ring gear function
  6. Balancers, dampeners and counterweights
    - (a) function
    - (b) design
    - (c) service precautions
  7. Camshaft
    - (a) function
    - (b) design and location
    - (c) construction terminology
    - (d) relationship to crankshaft
    - (e) function as an auxiliary drive
    - (f) bearings and lubrication
    - (g) relationship to engine performance
    - (h) measuring camshaft lobe and bearing wear
    - (i) bearing removal and installation procedure
  8. Valve train and assemblies
    - (a) types and designs
      - (i) valves
      - (ii) guides
      - (iii) rotators

- (iv) springs and retainers
  - (v) lifters
  - (vi) seals
  - (vii) bridges or cross heads
  - (b) recognition function and adjustment
  - (c) relationship of valve design to engine design
  - (d) relationship of valve design to heat dissipation
  - (e) valve removal and reconditioning methods
  - (f) major valve train repair methods, seats, guides, etc.
  - (g) importance of valve spring tension and installation
  - (h) refacing and reseating measurement precautions and methods
  - (i) reconditioning rocker arms
  - (j) lubrication provisions
  - (k) relationship of valve timing to engine performance
9. Cylinder head
- (a) types and designs
  - (b) function
  - (c) combustion chamber design (see item 10 below)
  - (d) relationship of design to heat and warpage
  - (e) construction characteristics
  - (f) removal procedures and precautions
  - (g) inspection and testing procedures
    - (i) cracks, warpage, stoppages
  - (h) assembly and installation procedures and precautions
  - (i) reconditioning procedures
10. Combustion chambers
- (a) types and designs, recognition and function of
    - (i) open
    - (ii) precombustion
    - (iii) energy cell
  - (b) applications
  - (c) relative terminologies
  - (d) remove, inspect and replacement of precombustion chambers and energy cells

## C. Engine systems

6 Hours

1. Induction systems
- (a) naturally aspirated
    - (i) styles, types and function of intake manifolds
    - (ii) manifold design in relation to air flow
    - (iii) installation procedures and precautions
    - (iv) result of leakage in air induction system
  - (b) turbo charger
    - (i) types and designs
    - (ii) principles of operation
    - (iii) functions
    - (iv) components
    - (v) turbo-charger maintenance procedures

- (c) air cleaners
  - (i) designs, styles, functions of air cleaners
  - (ii) types and operations of air cleaners

#### **D. Lubrication Systems**

**12 Hours**

1. Basic functions of oils
2. Recognition of grades and types
3. Lubricating oils and additives
4. Types and designs of lubricating systems
5. Filters and filter circuits
6. Servicing filter circuits
7. Diagnosis of pump failures, reconditioning procedures
8. Replacing and testing oil pumps including relief valves
9. Coolers, function, types and designs
10. Pressure indicators
11. Diagnosis of a faulty lubrication system
12. Oil analysis (as a diagnosis for engines)

#### **E. Cooling Systems**

**12 Hours**

1. Liquid systems
  - (a) types of liquid cooling systems
  - (b) principles of operation
  - (c) pressure and its relation to heat transfer and boiling points
  - (d) relation of materials to heat dissipation
  - (e) systems demand and layout
  - (f) recognition of components and sequence of operation of control devices
  - (g) radiator designs, function, materials and construction
  - (h) hose and clamp types
  - (i) function and designs of coolant pumps
  - (j) testing and reconditioning procedures
  - (k) designs, function of distributor tubes and nozzles
  - (l) designs, functions of thermostat, testing
  - (m) designs, functions of temperature and pressure indicators
  - (n) designs, functions, testing and adjusting shutters
  - (o) relation of vacuum and pressure to cooling system operation
  - (p) types of antifreeze chemicals
  - (q) calculating antifreeze ratio mixes
  - (r) pressure caps
2. Air cooling systems
  - (a) principles of operation
  - (b) limitations



- (c) basic design requirements
- (d) application of thermostats
- 3. Air circulating fans
  - (a) designs, styles and characteristics of fans and shrouds
  - (b) fan drives and styles, i.e. belt, viscous, fluid couplings
  - (c) fan drive testing and adjusting
    - (i) strand test
  - (d) reconditioning procedures
  - (e) electric fans

## **F. Crankcase Ventilation Systems**

**3 Hours**

1. Functions
2. Principles of operation
3. Components and their recognition
4. Relation to emission control
5. Service and diagnosis procedures

## **G. Exhaust Systems**

**6 Hours**

1. Functions, types and designs
2. Desired characteristics
3. Relationship to engine performance
4. Silencers and piping systems
5. Installation precautions — provisions for expansion/contraction
6. Indoor venting precautions

## **H. Starting Aids**

**3 Hours**

1. Basic functions
  - (a) preheating the coolant
2. Heating devices (block heaters and glo plugs)
  - (a) principle of operation
  - (b) applications
  - (c) operational methods and precautions
  - (d) types and designs of heating devices
3. Starting fluids
  - (a) procedures and precautions in the use of starter fluids

## **I. Emission Control (Introduction Only)**

**6 Hours**

1. Basic control problems of
  - (a) oxides of nitrogen
  - (b) carbon monoxide

- (c) hydrocarbons
- (d) particulates

#### **J. Repair Procedures (Engine)**

**21 Hours**

1. Dismantling methods and sequences
2. Lifting and hoisting procedures and precautions
3. Interpretation of manufacturer's manuals

#### **K. Fuel and Induction Systems (Introduction Only)**

**6 Hours**

1. Fuel identifications
2. Relation of fuel to engine design
  - (a) gasoline
  - (b) diesel
  - (c) propane
  - (d) compressed natural gas
3. Basic principles of carburetion
4. Types and designs of intake manifolds
5. Functions and application of intake manifold
6. Functions and application of the heat riser systems
7. Manifold installation procedures and precautions

### **SECTION TWO:**

### **AXLE ASSEMBLIES**

**54 Hours**

#### **A. Axles and Differentials**

1. Axle types
2. Principles of operation
3. Axle
  - (a) types and designs
  - (b) retaining methods
  - (c) methods of adjusting axle end play
4. Ratios
  - (a) how ratios are established and stated
  - (b) types of ratio
    - (i) hunting
    - (ii) nonhunting
    - (iii) partial nonhunting
    - (iv) timing
    - (v) recognition and interpretation of gear set markings
5. Recognition and function of major components
6. Differential gear terminology
  - (a) face

- (b) flank
  - (c) heel
  - (d) toe
  - (e) interpretation of tooth contact patterns
7. Assembly and adjustments
    - (a) bearing preload
    - (b) use of special tools and gauges
    - (c) methods of adjustments
    - (d) use of serviceable used bearings
  8. Lubricants and lubrication provisions
  9. Proper installation methods of seals
  10. Introduction to
    - (a) single speed double reduction units
    - (b) 2 speed single reduction units
    - (c) setting up measurement and adjustments
    - (d) diagnosis procedures
    - (e) interpretation of manufacturer's markings
  11. Positive drive differential units
    - (a) recognition and principle of operation
    - (b) repair and assembly procedures
    - (c) type and designs
    - (d) diagnosis and application of planetary gears
  12. Overhaul procedures and sequences
    - (a) use of special tools and gauges
    - (b) dismantling and reassembly procedures
    - (c) bearing preloads and torque

## **SECTION THREE:**

## **DRIVE LINES**

**6 Hours**

### **A. Drive Lines**

1. Common types and applications
  - (a) hotchkiss
  - (b) torque tube
2. Construction details
  - (a) provision for balance
  - (b) provision for variance in length
3. Types and designs of universal joints
4. Function and limitations of U-joints
5. Provision for U-joint lubrication
6. U-joint installation precautions (alignment)
7. Function of slip joints
8. Function of centre support bearings

9. Diagnosis
10. Universal joint service and repair (front and rear drive)
  - (a) application of constant velocity types
  - (b) service precautions of constant velocity universal joints
11. Inspection and diagnosis of centre supports and bearings
12. Drive shaft timing, balance and angles

<b>SECTION FOUR:</b>	<b>BASIC ELECTRICAL</b>	<b>22 Hours</b>
<b>A. Review</b>		<b>3 Hours</b>
1. Electrical terminologies		
2. Simple applications		
<b>B. Ohm's Law</b>		<b>3 Hours</b>
1. Applications to automotive equipment		
2. Equations and their use		
<b>C. Conductors and Insulators</b>		<b>3 Hours</b>
1. Recognition of materials		
2. Functions and applications		
3. Relationship to circuits		
<b>D. Circuit Types</b>		<b>3 Hours</b>
1. Recognition		
2. Series and parallel		
3. Applications		
4. Use of circuits		
<b>E. Circuit Protection</b>		<b>3 Hours</b>
1. Fuses		
2. Circuit Breakers		
3. Fuseable links		
<b>F. Interpretation of Circuit Diagrams</b>		<b>7 Hours</b>

## THIRD PERIOD TECHNICAL TRAINING

<b>SECTION ONE:</b>	<b>CHARGING SYSTEMS</b>	<b>76 Hours</b>
<b>A. Electron Theory</b>		<b>6 Hours</b>
1. Recognition of electrical energy		
2. The electron theory of matter		
3. Recognition and interpretation of electrical terms		
(a) volts		
(b) amperes (milli-amps)		
(c) ohms		
(d) direct current/alternating current		
(e) conductors		
(f) insulators		
(g) semi-conductors		
<b>B. Magnetism</b>		<b>3 Hours</b>
1. The phenomenon of magnetism		
2. Electromagnetism		
3. Applications to automotive equipment		
<b>C. Measuring Units and Instruments</b>		<b>9 Hours</b>
1. Use of instruments		
2. Interpretation of instruments		
<b>D. Circuit and Failures</b>		<b>6 Hours</b>
1. Shorts		
2. Opens		
3. Grounds		
<b>E. Mechanical Components Principles of Operation and Function</b>		<b>9 Hours</b>
1. Solenoids		
2. Switches		
3. Variable controls		
4. Resistors		
<b>F. Testing Procedures and Precautions</b>		<b>14 Hours</b>
1. Use and care of equipment		
2. Interpretation of test procedures		

3. Testing procedures
  - (a) on vehicle
  - (b) off vehicle

**G. Batteries**

**2 Hours**

1. Construction
2. Function
3. Service

**H. Alternator (A.C. Generator)**

**21 Hours**

1. Principle of operation
2. Recognition and function of components
  - (a) terminology
  - (b) location and function
3. Testing procedures and precautions
  - (a) stator
  - (b) rotor
  - (c) diodes
  - (d) slip ring and brushes

**I. Voltage Regulators**

**6 Hours**

1. Recognition of types
2. Functions
3. Principles of operation
4. Remove and replace precautions
  - (a) limitation of interchangeability
5. Relation to the ignition switch
6. Testing

**SECTION TWO: CRANKING SYSTEMS**

**33 Hours**

**A. Motors**

**12 Hours**

1. Recognition of circuitry
2. Recognition and functions of components
3. Principles of operation
4. Relation to other equipment and circuits
5. Diagnosis and testing

**B. Cranking System Drives**

**3 Hours**

1. Current types and designs
2. Principles of operation

3. Provisions for weather proof operation
4. Installation precautions
5. Diagnosis and testing

**C. Starter Switch Systems 3 Hours**

1. Recognition and function of components
2. Solenoids and relays
3. Relation to ignition systems
4. Principles of operation (components)
5. Safety provisions
6. Relation to charging systems
7. Diagnosis and testing

**D. Recognition of Common Failures (Shop Only) 7 Hours**

1. Circuit failures
  - (a) testing for opens, shorts and grounds
  - (b) testing for faulty components
  - (c) testing circuit resistance
2. Mechanical failures
  - (a) loss of starter operation
  - (b) drive failures

**E. Service Procedures and Precautions 2 Hours**

**F. "On Vehicle" and "Bench" Diagnosis Procedures 6 Hours**

**SECTION THREE: IGNITION SYSTEMS 49 Hours**

**A. Recognition of Types 5 Hours**

1. Breaker contact
  - (a) functions
  - (b) principles of operation
2. Electronic
  - (a) functions
  - (b) principles of operation

**B. Distributor 6 Hours**

1. Principle of operation
2. Relation to engine design
3. Major function



4. Components, recognition and principle of operation
  - (a) condenser
  - (b) contact points
  - (c) spark advance systems
  - (d) electronic units
5. Interpretation of test procedures and specifications
6. Diagnosis procedures
7. Adjustment provisions and limitations
8. Cap designs

**C. Ignition Coil** **1 Hour**

1. Function
2. Principles of operation
3. Testing procedures
4. Diagnosis
5. Polarity

**D. Spark Advance and Retard Systems** **3 Hours**

1. Types and functions
2. Principles of operation
3. Relationship to fuel
4. Diagnosis
5. Adjustment provisions and limitations
6. Relationship to emission control systems

**E. High Tension Leads (Ignition)** **1 Hour**

1. Construction, core and insulation
2. Effects of insulation breakdown
3. Effects of core failure
4. Testing and diagnosis

**F. Ignition Switch** **3 Hours**

1. Basic functions
2. Secondary functions
  - (a) vehicle security
  - (b) other circuits — starter, accessories, etc.
3. Diagnosis

<b>G. Spark Plugs</b>	<b>2 Hours</b>
1. Function	
2. Classification and identification	
3. Relationship to engine design	
4. Diagnosis and testing	
5. Installation precautions	
<b>H. Electronic Ignition Systems</b>	<b>12 Hours</b>
1. Principles of operation	
2. Recognition and function of components	
3. Diagnosis and testing procedures	
<b>I. Computer Ignition Systems</b>	<b>16 Hours</b>
1. Principles of operation	
2. Recognition and function of components	
3. Diagnosis and testing procedures	
<b>SECTION FOUR: ALL-FUEL SYSTEMS</b>	<b>54 Hours</b>
<b>A. Fuels</b>	<b>3 Hours</b>
1. Basic composition	
2. Properties and characteristics	
3. Function of additives	
4. Octane rating and its relation to engine design	
5. Handling, storage procedures and safety	
6. Fuels and emission control	
7. Effects of temperature change	
<b>B. Fuel Tanks</b>	<b>1 Hour</b>
1. Required structural details	
(a) venting	
(b) baffles	
2. Relationship to emission control systems	
3. Repair procedures and precautions	
(a) safety and draining	

- C. Fuel Pumps** **3 Hours**
1. Types and applications
  2. Principles of operation
  3. Relationship to the carburetor and fuel line safety
  4. Testing procedures
  5. Diagnosis
  6. Screens and filters
  7. Specific pressures (before injector pump)
- D. Fuel and Induction Systems** **2 Hours**
1. Fuel identifications
  2. Relation of fuel to engine design
  3. Types, designs and functions of intake manifolds
  4. Manifold installation procedures and precautions
- E. Carburetor** **21 Hours**
1. Principles of operation
  2. Functions and application
  3. Recognition of types and designs
  4. Recognition and function of parts and components
    - (a) safety precautions with open fuel lines
  5. Basic and secondary circuitry
  6. Emission control devices
    - (a) principles of operation
    - (b) relationship to the carburetion processes
  7. Automatic choking mechanisms
    - (a) functions
    - (b) principles of operation
    - (c) types and designs
    - (d) diagnosis
  8. Diagnosis and adjusting procedures
    - (a) interpretation of manufacturer's manuals
    - (b) relationship to engine condition
    - (c) relationship to automatic transmission operation
  9. Air cleaner systems
  10. Heat riser systems

**F.   Liquified Petroleum and Natural Gas Fuel Systems** **12 Hours**

1. Principles of operation
2. Recognition and function of components
3. Fuel handling and storage precautions
4. Hazardous characteristics of L.P. and natural gas

**G.   Gasoline Fuel Injection** **12 Hours**

1. Continuous injection system
  - (a) system recognition
  - (b) basic components
  - (c) principles of operation
2. Electronic injection systems
  - (a) types of electronic systems
  - (b) basic components
  - (c) principles of operation

**SECTION FIVE:           TUNE-UP AND ACCESSORIES** **28 Hours**

**A.   Testing Procedures**

1. Engine condition
2. Isolating specific malfunctions
3. Interpreting visual conditions

**B.   Attachment and Use of Scopes and Analyzers**

1. Interpretation of readings and patterns
2. Application of engine specifications
3. Identification of specific malfunctions

**C.   Relationship of Engine Performance to Drive Train Units**

1. Automatic transmissions
2. Differential gear ratios

**D.   Emission Control Systems**

1. Recognition and function of components
2. Principles of operation
3. Use and reading of diagrams

**E.   Interrelationship of Engine Tune and Other Systems**

1. Cooling
2. Lubrication

3. Diagnosis procedures
4. Repair procedures and precautions
5. Exhaust systems

**F. Engine Service Indicator Systems**

1. Temperature
2. Oil pressure
3. Fuel level
4. Charging system
  - (a) principle of operation
  - (b) diagnosis
  - (c) service procedure

**G. Horns**

1. Diagnosis
2. Service procedures

**H. Traffic Signal Indicators**

1. Principles of operation
2. Diagnosis
3. Relation to the brake lights

**I. Warning Indicators**

1. Brake system
2. Hand (parking) brake
3. Seat belt
4. Principles of operation
5. Diagnosis procedures

**J. Headlight Systems**

1. 2 and 4 unit systems
2. Aiming procedures
  - (a) seal beams
  - (b) high intensity
3. Diagnosis

**K. Parking and Brake Light Systems**

1. Principles of operation
2. Diagnosis

**L. Windshield Wiper and Washer Mechanisms**

1. Types and designs
2. Principles of operation
3. Speed regulating devices
4. Diagnosis

**M. Rear Window Defrosters and Defoggers**

1. Principle of operation
2. Diagnosis

**N. Power Seat Adjusting Systems**

1. Principles of operation
2. Diagnosis procedures

**O. Power Windows and Door Locks**

1. Principles of operation
2. Diagnosis procedures

**P. Automatic Speed Control Systems**

1. Principles of operation
2. Diagnosis procedures

**Q. Reading Circuit Diagrams**

## FOURTH PERIOD TECHNICAL TRAINING

<b>SECTION ONE:</b>	<b>AUTOMATIC TRANSMISSIONS</b>	<b>160 Hours</b>
<b>A. Basic Applications of Science Principles</b>		<b>9 Hours</b>
1. Hydraulics		
2. Friction		
3. Leverage		
4. Properties of hydraulic fluid		
5. Torque		
<b>B. Basic Components</b>		<b>35 Hours</b>
1. Recognition and function		
2. Principles of operation		
3. Relation to total unit operation		
4. Failure diagnosis procedures		
5. Relationship to other components and condition		
<b>C. Torque Converters</b>		<b>18 Hours</b>
1. Principles of operation		
2. Operational terminologies		
3. Types, designs and applications		
4. Testing and inspection		
5. Service procedures and precautions		
6. Converter control systems		
7. Diagnostic procedures		
<b>D. Governors</b>		<b>6 Hours</b>
1. Principles of operation		
2. Function		
3. Diagnostic interpretations		
4. Testing and adjusting procedures		
<b>E. Valves</b>		<b>20 Hours</b>
1. Function and principles of operation		
2. Diagnosis and service procedures		
(a) throttle valve		



- (b) shift valves
- (c) manual valves
- (d) cushioning valves
- (e) pressure regulator

<b>F. Clutches and Bands</b>	<b>14 Hours</b>
1. Types and application	
2. Principles of operation	
3. Construction characteristics	
4. Operational methods and devices	
5. Diagnosis and service procedures	
<b>G. Oil Pumps</b>	<b>5 Hours</b>
1. Types and applications	
2. Diagnosis and testing procedures	
3. Repair procedures and precautions	
4. Function and principles of operation	
<b>H. Modulators</b>	<b>3 Hours</b>
1. Purpose and application	
2. Diagnosis and testing	
3. Inspection and adjusting procedures	
<b>I. Hydraulic Circuits</b>	<b>15 Hours</b>
1. Interpretation of manufacturer's manuals	
2. Circuit recognition	
3. Interrelationship of hydraulic circuits	
<b>J. Planetary Gear Applications</b>	<b>10 Hours</b>
1. Over drives	
<b>K. Remove and Installation Procedures and Precautions</b>	<b>2 Hours</b>
<b>L. Disassembly and Reassembly Procedures</b>	<b>7 Hours</b>
<b>M. Trans Axles (Front Wheel Drive)</b>	<b>16 Hours</b>
1. Types	
2. Characteristics	
3. Functions	
4. Terminologies	

5. Service adjustments

6. Service precautions

## **SECTION TWO:**

## **AIR CONDITIONING**

**30 Hours**

### **A. Air Conditioning**

1. Principles of operation
2. Recognition and function of components
3. Characteristics of the refrigerant types
4. Manual and automatic controls
5. Diagnostic procedures and precautions
  - (a) testing equipment
6. Factory equipment as compared to "after market" equipment
7. Relationship to other systems
8. Types of systems and their limitations

## **SECTION THREE:**

## **SPECIAL OPTIONS**

**20 Hours**

Objective: To provide an adequate introduction to product training and diagnostic procedures.

### **A. New Developments in the Automotive Industry**

1. "Plug-in" analysis systems
2. Electronic developments
3. Computer systems, etc.

NOTE: This section is subject to continuous review and revision by the Apprenticeship and Trade Certification Division Training Institutes.

## **SECTION FOUR:**

## **FUEL INJECTION SYSTEMS**

**20 Hours**

### **A. Fuel Injection Systems (Diesel)**

1. System recognition type
  - (a) identification of injection systems
  - (b) principles of operation
  - (c) design variations and applications
  - (d) adjusting and timing procedures
  - (e) diagnosis, inspection and corrective procedure
  - (f) fuel transfer pump, supply and return lines
  - (g) operation, testing lines and transfer pump
  - (h) service and installation procedures

- (i) filters
  - (i) water
  - (ii) fuel
- (j) cetane ratings
- (k) glow plug circuits

**SECTION FIVE:**

**REVIEW**

**10 Hours**

## **SUGGESTED REFERENCE MATERIALS**

Automotive Technology — Nash and Banitz — McGraw Hill — Latest Edition

Automotive Mechanics and Technology — Tillman and Steckner —  
Latest Edition

Auto Mechanics Fundamentals — Stockel — Goodheart Wilcox —  
Latest Edition

Auto Service and Repairs — Stocker — Goodheart Wilcox — Latest Edition

Automechanics — Ellinger — Prentice Hall — 2nd Edition

Principles of Wheel Alignment Service — Bacon — McGraw Hill —  
Latest Edition

Hydraulic Disc and Drum Brake Manual — Wagner Electrical Corp. —  
Latest Edition

Automotive Electrical Systems — Ellinger — Prentice Hall — Latest Edition

Classroom and Service Manuals — Check Chart

Champion and Autolite Tune-Up

Motors Automatic Transmission — Ritchen — Latest Edition

Automotive Basic Service Air Conditioning Service Manual — Mitchel —  
Latest Edition

## **TECHNICAL TRAINING SCHOOLS**

The Motor Mechanic Apprenticeship training program is offered by the Alberta Manpower, Apprenticeship and Trade Certification Division. Staff and facilities for teaching the program are supplied by Alberta Manpower Division at:

1. Northern Alberta Institute of Technology
2. Southern Alberta Institute of Technology
3. Lethbridge Community College
4. Fairview College
5. Keyano College
6. Lakeland College
7. Medicine Hat College
8. Red Deer College

## **LOCATION OF APPRENTICESHIP AND TRADE CERTIFICATION DIVISION REGIONAL OFFICES**

CALGARY

EDMONTON

FORT McMURRAY

GRANDE PRAIRIE

HINTON

LETHBRIDGE

MEDICINE HAT

PEACE RIVER

RED DEER

VERMILION

GOVERNMENT OF THE PROVINCE OF ALBERTA

ALBERTA REGULATION 327/81

THE MANPOWER DEVELOPMENT ACT

Motor Mechanic Trade Regulation

1(1) In this regulation

(a) "motor mechanic" means a person engaged in the repair, maintenance, overhaul or modification of motor vehicles;

(b) "General Regulations" means the General Regulations under *The Manpower Development Act*, (Alta. Reg. 43/77);

(c) "trade" means the trade of motor mechanic.

(2) The definitions in the General Regulations apply in this regulation.

(3) This regulation does not apply to the holder of a certificate of proficiency as a gasfitter with respect to the installation, repair, adjustment and maintenance of natural gas or propane systems designed to provide alternate or principal carburation in motor vehicles.

AR 327/81;126/82

PART 1

APPRENTICESHIP AND TRADE TRAINING

2 A person is eligible to be an apprentice motor mechanic if he satisfies the requirements of section 5 of the General Regulations, and either

(a) produces evidence of at least a grade 9 education, or the equivalent, or

(b) passes the entrance examination prescribed by the Board.

AR 327/81

3(1) Subject to subsections (2), (3) and (4), an employer who is a journeyman, or who employs a journeyman, may employ one apprentice and may employ one additional apprentice for each additional journeyman he employs.

(2) The Director may authorize an employer to employ an apprentice in addition to those permitted under subsection (1), on a temporary basis, to train him in a branch of the trade not engaged in by the employer to whom he is apprenticed.

(3) For the purpose of subsection (1), an apprentice employed temporarily under subsection (2) shall not be considered to be an apprentice of his temporary employer.

(4) If the supply of journeymen in a location where an employer is carrying on business is insufficient to permit the employer to carry out his work commitments, the Director may authorize the employer to employ apprentices in addition to those permitted under subsections (1) and (2).

AR 327/81

4(1) The term of apprenticeship shall consist of 4 periods of 12 months each.

(2) Each period referred to in subsection (1) shall consist of not less than 1800 hours of on the job training, inclusive of time spent attending the technical training course prescribed by the Board.

(3) The Director may not, under section 25(1) of the Act, reduce the term of apprenticeship to be served by an apprentice to less than one period of apprenticeship.

AR 327/81

5 When a contract of apprenticeship is registered with the Director, he shall issue to the apprentice an official record book referred to in section 14 of the General Regulations.

AR 327/81

6(1) An apprentice shall not advance to the next period until the Director has authorized him to do so by making an entry in the apprentice's official record book, under subsection (2).

(2) The Director shall make an entry in the apprentice's official record book authorizing advancement to the next period, when the apprentice:

(a) has completed the previous period of apprenticeship,

(b) has received in the opinion of the Director, a satisfactory report from:

(i) his employer, and

(ii) the school at which he attended technical training courses prescribed by the Board,

(c) has completed the tests and examinations prescribed by the Board, and

(d) has attained passmarks prescribed by the Board in the tests and examinations referred to in clause (c).

AR 327/81

7 The official record book of an apprentice shall be kept in the possession of his employer, and on termination of the employment of the apprentice, the employer shall present the completed book to him.

AR 327/81

8(1) An employer shall pay wages to an apprentice that are not less than the following percentages of the prevailing wages paid to a journeyman:

(a) 55% in the first period;

(b) 70% in the 2nd period;

(c) 80% in the 3rd period;

(d) 90% in the 4th period.

(2) Notwithstanding subsection (1), the wages paid to an apprentice shall not be less than the minimum wage fixed pursuant to *The Employment Standards Act*.



(3) An employer is not required to pay wages to an apprentice during the time that the apprentice spends attending training courses prescribed by the Board.

AR 327/81

9 The hours of work and working conditions of an apprentice shall be the same as those of a journeyman.

AR 327/81

## PART 2

### CERTIFICATION

10 The Director may issue the following classes of certificates:

- (a) Certificate of Proficiency;
- (b) Temporary Certificate.

AR 327/81

11 In accordance with section 50(d) of the General Regulations, the Director may issue a Certificate of Proficiency without examination to a person who holds

- (a) a Certificate of Completion of Apprenticeship for the trade issued by another province within Canada, or
- (b) a Certificate of Qualification or a Certificate of Proficiency for the trade, issued by another province within Canada, bearing an Interprovincial Standards Red Seal.

AR 327/81

12(1) An application to take an examination for a Certificate of Proficiency shall be made to the Director.

(2) Documentary evidence acceptable to the Director shall be presented by an applicant for an examination showing that the applicant

- (a) holds a certificate equivalent to an Alberta Certificate of Proficiency issued by a provincial authority outside Alberta, or
- (b) has at least 4 years of acceptable work experience in the trade.

(3) The applicant shall provide translations into the English language, acceptable to the Director, of credentials other than in English, submitted pursuant to subsection (2).

AR 327/81

13(1) The Director may issue a Temporary Certificate to a person if

- (a) that person has complied with section 12,
- (b) the Director has approved the application for examination made under section 12(1), and
- (c) the applicant has attained a mark of not less than 70% of the pass mark on the examination prescribed by the Board.

(2) Notwithstanding subsection (1)(c), the Director may, when in his opinion extenuating circumstances warrant the action, issue a Temporary

Certificate to a person who has attained a mark of less than 70% of the pass mark on the examination prescribed by the Board.

(3) A Temporary Certificate entitles the holder to work as a motor mechanic under the supervision of a journeyman.

AR 327/81

14 A Certificate of Proficiency issued under this regulation is effective unless cancelled or suspended by the Director in accordance with section 60 or 61 of the General Regulations, or section 48 of *The Manpower Development Act*.

AR 327/81

15 Alberta Regulations 153/57 and 387/65 are repealed.

AR 327/81









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